

March 23, 1937.

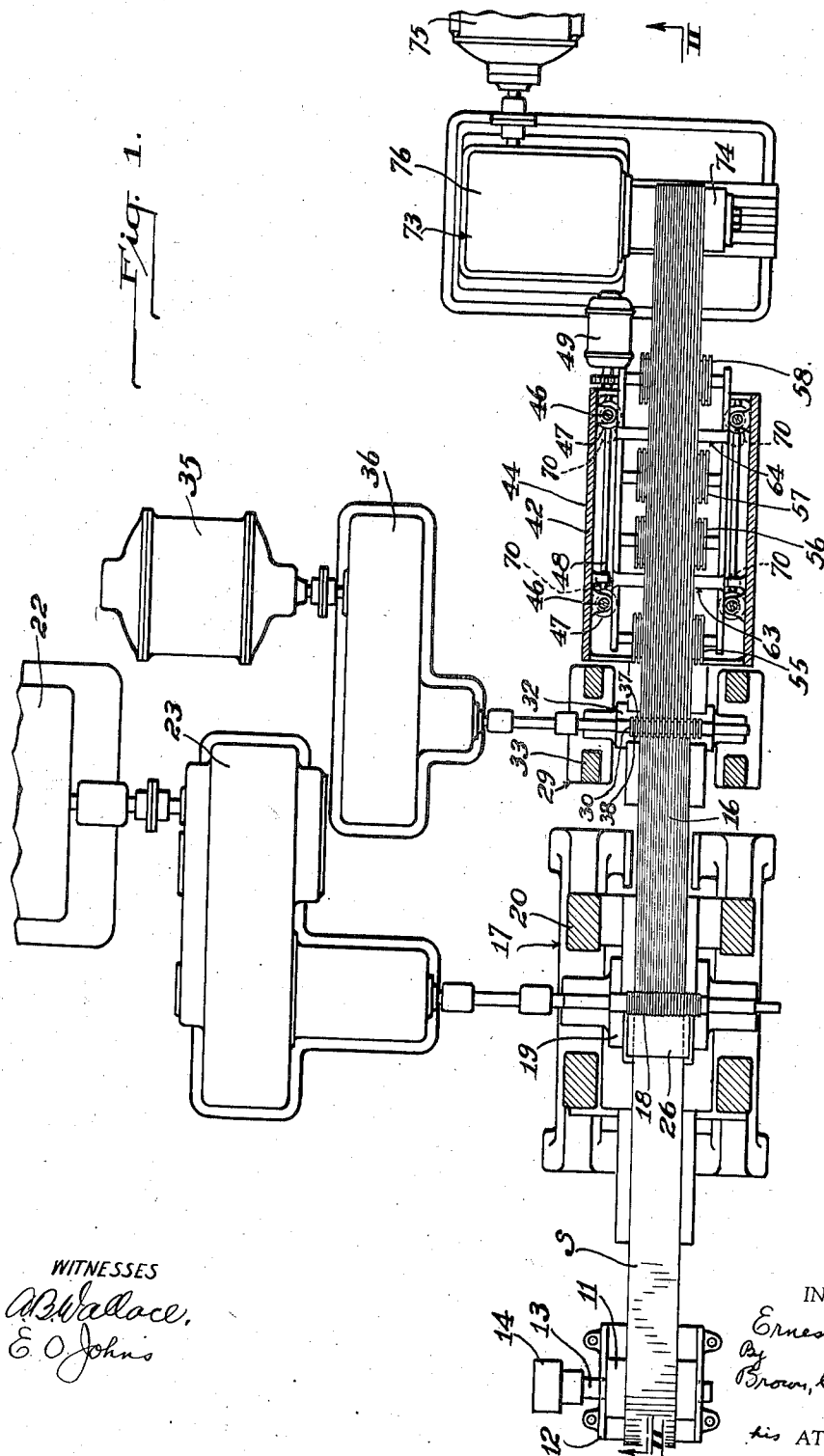
E. E. TROSS

2,074,713

MEANS AND METHOD OF MAKING WIRE AND THE LIKE

Filed Oct. 19, 1935

3 Sheets-Sheet 1



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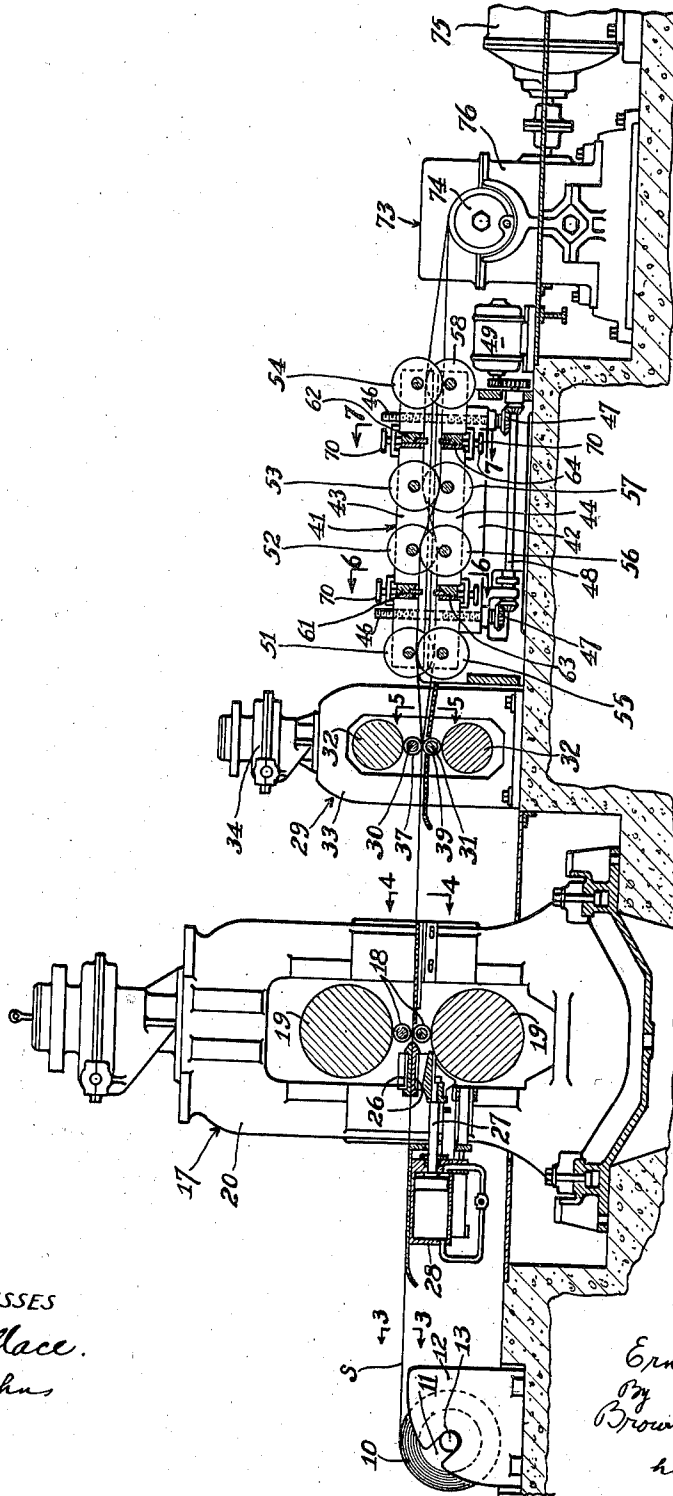
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3 Sheets-Sheet 2

Fig. 2.



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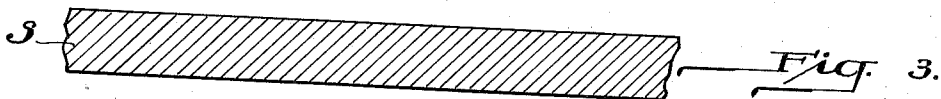
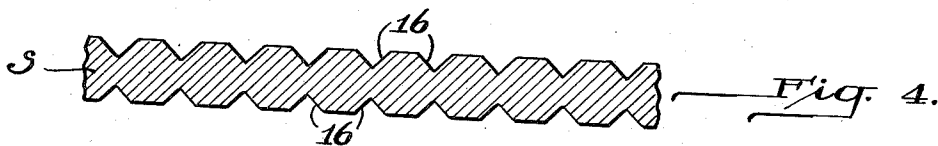
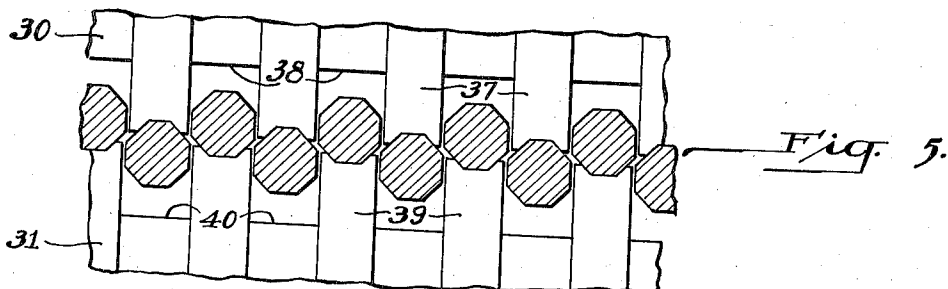
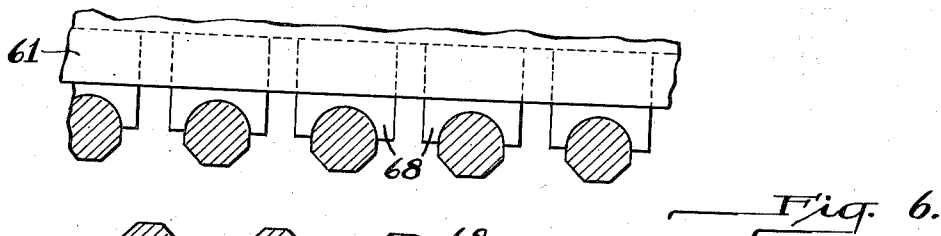
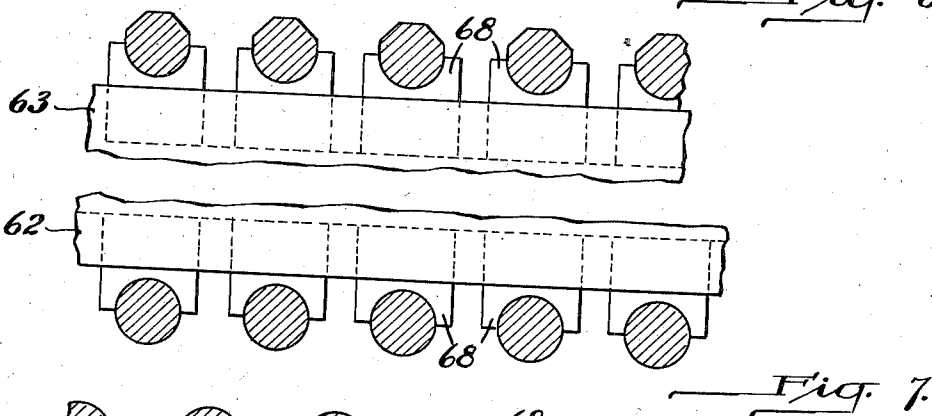
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MEANS AND METHOD OF MAKING WIRE AND THE LIKE

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3 Sheets-Sheet 3



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2,074,713

MEANS AND METHOD OF MAKING WIRE
AND THE LIKEErnest E. Tross, Youngstown, Ohio, assignor to
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Application October 19, 1935, Serial No. 45,773

20 Claims. (Cl. 29—33)

This invention relates to apparatus and processes for commercially manufacturing wire, rod and other strand elements from sheet metal or strip.

5 Prior to the present invention various means and methods have been suggested for the manufacture of wire from sheet metal. Obviously a considerable saving in time, labor and resulting wire cost could be effected by rolling an ingot to sheet form with a subsequent efficient separation
10 of the sheet to wires. This would eliminate the relatively tedious and expensive usual present practice of making wire by rolling an ingot to bar form with a cold drawing of the wire.

15 However, known machines and methods of making wire from sheets or strip have not been readily adapted to commercial production methods and moreover have been open to the objection that the initial and maintenance costs of the apparatus were high. This has been due chiefly
20 to the fact that the most successful of the prior types of apparatus have had a relatively large number of rolls of special shape for reducing the wire or rod from sheet form. Again, many of
25 the known apparatus produce the wire from plates or slabs so that the operation has been relatively slow and expensive since considerable rolling and shaping is required.

In certain of the prior known methods and apparatus grinding wheels have been incorporated
30 to remove burrs and the like from the stranded elements and this has added materially to the time and cost of manufacture. Trouble has also been experienced in former practices in obtaining a round wire or rod and a plurality of rolling
35 operations have been necessary and even then the burr formed by the original separation of the plate, slab or sheet into a wire-like element has not been completely erased. Moreover the severe
40 rolling operation often leaves fins or burrs of its own creation.

It is an object of the present invention to avoid and overcome the foregoing and other difficulties of prior practices and apparatus for making wire
45 by the provision of improved means and methods for commercially manufacturing wire, rod or the like of desired cross-sectional configuration directly from sheet metal or strip.

50 Another object of the invention is to provide a novel method of rapidly and effectively making stranded elements from flat sheet.

Another object of the invention is to provide substantially automatic apparatus for manufacturing wire or rod, of any desired configuration

and free from surface ridges or roll marks, from sheet metal or strip.

In the practice of my inventive method a sheet or strip of metal is rolled to provide channels therein on opposite sides which define the wires
5 to be produced with a subsequent separation of the sheet through the channels to provide a plurality of wire-like elements of polygonal cross section. The elements are then pulled under tension across or through a plurality of axially spaced
10 dies, which together circumferentially enclose the elements, to thereby trim the elements to wires of any desired cross section, generally round. The wires are usually coiled to facilitate handling but they may be passed directly to apparatus
15 for shearing into lengths, annealing, or the like.

My invention also includes apparatus for commercially manufacturing wire, rod or the like from sheet metal or strip, and in the preferred
20 form of the invention means are provided for channeling opposite sides of the strip to define the wires with further means for separating the strip at the channels into the wire-like elements. A plurality of longitudinally spaced dies, with
25 each only partially surrounding the elements, but together completely surrounding the elements, are employed together with means for drawing the elements through the dies under tension to shape the elements into wires of the proper cross-sectional
30 shape.

In the accompanying drawings Fig. 1 is a plan view, partially broken away, of one embodiment of apparatus constructed in accordance with the principles of the present invention; Fig. 2 is a
35 longitudinal, vertical, cross-sectional view taken on line II—II of Fig. 1; Fig. 3 is a transverse, vertical, cross-sectional view taken on line III—III of Fig. 2 and illustrating the cross-sectional shape of the strip prior to working; Fig. 4 is a
40 vertical, transverse, cross-sectional view taken on line IV—IV of Fig. 2 and showing the strip after grooving; Fig. 5 is a vertical, transverse, cross-sectional view taken on line V—V of Fig. 2 and illustrating the strip after it has been separated
45 into a plurality of elements; Fig. 6 is a transverse, vertical, sectional view taken on line VI—VI of Fig. 2 and showing the trimming of the wire-like elements; and Fig. 7 is a view similar to Fig. 6 but is taken on line VII—VII of Fig.
50 2 and illustrates the further trimming of the wire-like elements to the desired cross-sectional contour.

Referring more particularly to the drawings, the letter S indicates the flat sheet metal or strip
55

ordinarily employed in the practice of the invention, and for ease of handling and in order to apply the proper back tension to the strip it is usually coiled as at 10 and carried upon a drum 11 in a suitable coil box 12. Some means are preferably provided for applying a controlled braking tension to the strip S, and in the form of the invention illustrated this is accomplished by providing the drum 11 with a shaft 13 which is releasably received in a braking unit 14 of any desired type, such as dynamic or frictional.

From the coil box the strip S is passed to mechanism for channeling or grooving the strip from its flat cross-sectional shape, as shown in Fig. 3, to the contour shown in Fig. 4, wherein the grooves are identified by the numeral 16. Preferably the grooves 16 are of triangular shape, not only because of the ease of forming them in this shape, but also because the shape facilitates the formation of a polygonal wire and particularly a round wire. The grooving mechanism, indicated generally by the numeral 17, preferably comprises a roll stand of the backing roll type having work-engaging rolls 18 and backing rolls 19 all carried in a standard frame 20. At least the work-engaging rolls 18 are driven as by a motor 22 through a gear box 23. The work-engaging rolls 18 are formed with integral or removable triangularly shaped ribs which operate to form the grooves or channels 16 on the strip S, as seen in Fig. 4, in opposed, aligned, parallel relation with the spacing between the grooves 16 being such as to substantially define the wires or rods to be formed from the strip.

Means are preferably associated with the roll stand for feeding the strip S between the work-engaging rolls 18. These may be of the well-known sticker type which briefly includes clamping jaws 26 carried by piston rod 27 of an air-cylinder 28. Thus by clamping the jaws 26 about the strip S and operating the air-cylinder 28 the strip S can be fed positively through the rolls 18 with the jaws 26 then being released and retracted to such a position that they serve merely as a guide or if desired they may be partially clamped against the strip to provide a slight tensioning action upon the strip S passing therethrough.

From the channeling mechanism 17 the strip S passes to apparatus for separating the strip into a plurality of wire-like elements. The sheet is separated at the opposed channels as best illustrated by a comparison of Figs. 4 and 5. The separating operation can be performed either by a true shearing or slitting operation or it may be done by a tearing operation. More particularly, in the embodiment of the invention illustrated and described herein, the apparatus for separating the strip into a plurality of elements is indicated as a whole by the numeral 29 and includes work-engaging rolls 30 and 31 which are backed by supporting rolls 32. The rolls are journaled in and carried by a suitable frame 33 with the usual adjusting means 34 being provided to control the clearance between the rolls 30 and 31. A motor 35 operating through a gear box 36 is preferably provided for driving the rolls 30 and 31.

The roll 30 is formed with spaced flanges 37 which define grooves 38 and in a like manner roll 31 is formed with flanges 39 which define grooves 40. The flanges 37 are in alignment with or opposed to the grooves 40 and the flanges 39 of roll 31 are aligned with and opposed to the grooves 38 of roll 30. Thus a shearing operation

is provided upon the sheet S and separation of the individual wire-like elements is readily accomplished as illustrated in Fig. 5.

From the separating or shearing apparatus 29 the wire-like elements pass to a trimmer indicated generally by the numeral 41 which includes a base 42 carrying side frames 43 and 44. The side frames 43 and 44 are adjustable toward and from each other by the provision of opposite hand-screws 46 which are operated by bevelled gearing 47 through a shaft 48 driven by a motor 49. The side frames 43 and 44 carry and journal a plurality of pulleys or rollers 51 to 58 which receive the individual elements from the separating apparatus and which further separate the elements so that they may be properly trimmed as hereafter explained. More particularly every other element passes over the aligned pulleys or rollers 55 and 56 and then under the pulleys or rollers 53 and 54. The alternate elements pass under the pulleys or rollers 51 and 52 and then over the pulleys or rollers 57 and 58. Thus in operation two sets of spaced-apart elements are provided with first one set being positioned above the other set and then with their positions reversed.

With the wire-like elements carried and separated as just described they are trimmed up to the desired cross-sectional contour. This is accomplished in the embodiment of the invention illustrated by providing transversely extending bars 61 and 62 on the side frames 43 and transverse bars 63 and 64 on the side frames 44. The transverse bars 61, 62, 63 and 64 all carry dies or trimming blades 68 as indicated in Fig. 6. These dies may of course be made of any desired cutting contour but are formed half round for making round wire. As seen from Fig. 6, while the dies 68 carried by the transverse bar 61 are trimming approximately the upper half of the circumference of the wire-like elements carried in the upper position, the dies 68 carried by the transverse frame 63 are trimming approximately the lower half of the circumference of the elements in the lower position. When the positions of the two sets of elements are reversed as above explained the dies or cutter blades 68, carried by the transverse bars 62 and 64, engage with the untrimmed sides of the wire-like elements to complete the circumferential trimming or shaping thereof as shown in Fig. 7.

The vertical position of the transverse bars 61, 62, 63 and 64 with respect to the side frames 43 and 44 can be controlled as by the provision of slot guides for the ends of the transverse bars with adjustable hand-screws 70 for moving the bars up or down on the side frames. Thus the particular force or angle with which the dies 68 engage with the wire-like elements can readily be controlled. The adjustment of the clearance between the side frames 43 and 44 by the operation of the motor 49 determines the distance separating the upper row of elements from the lower row.

Leaving the trimmer 41 the strip S passes to a coiler, indicated generally by the numeral 73, which includes a collapsible drum 74 driven by a motor 75 through a gear box 76. The coiler 73 is adapted to pull the wire-like elements through the apparatus under considerable tension as created by the tensioning mechanism 14 whereby the various grooving, separating and trimming operations are more effectively and accurately performed.

It is believed that the operation of the appa-

ratus will be apparent from the foregoing description. However, briefly summarizing, the strip S, in coil form and carried by the coil box 12, is initially fed through the entire apparatus with at least the rolls 30 and 31 and the side frames 43 and 44 separated so that the fastening of the strip to the coiling drum 73 is facilitated. The work-engaging rolls 18 are then adjusted to channel the strip and with the entire apparatus running slowly the strip is slowly advanced. The slitter or separating apparatus 29 is brought into operation when the channeled portion of the strip S has reached it. Thus the strip S is divided into a plurality of wire-like elements and as continued forward movement of the strip brings the separated elements to the trimming apparatus 41 the motor 49 is operated to move the side frames 43 and 44 towards each other so that the rollers 51 to 58 engage with and separate the elements into two distinct planes. The trimming dies 68, carried by the transverse bars 61 to 64, are then adjusted into contact with the sides of the elements by operation of the hand-wheels 70. When the apparatus is satisfactorily functioning to form round wires or rods the operation continues until the entire strip or sheet has been made into wire.

While the invention is applicable broadly to making wires and rods of various sizes and characteristics, it is also particularly adapted to the manufacture of welding rods as described and claimed in my copending application Serial No. 7,194, filed February 19, 1935. Thus, after rolling an ingot to sheet form having the relatively pure uncontaminated metal at the edges of the sheet it totalling approximately one-quarter of the total width of the sheet (one-eighth on both sides), the pure metal portions are sheared off. Subsequent handling of the sheared-off portions in accordance with my herein disclosed apparatus and process results in the production of a particularly pure and effective welding rod which can be manufactured efficiently in commercial quantities.

The apparatus and method of the invention are particularly adapted to the rapid and yet satisfactory commercial manufacture of wires, rods and the like. Heavy initial or maintenance costs for apparatus are avoided. The roll and other tool equipment is relatively simple, rugged and long-lived. Rolling of the separated wire-like elements is avoided and by pulling the elements under tension over dies which only partially surround the circumference of the elements the die cost, as well as ease of adjusting the dies, sharpening, etc., is materially improved. Accordingly, the above-stated objects of the invention are achieved.

In accordance with the patent statutes one embodiment of the apparatus and several manners of practicing the invention have been illustrated and described in detail. However, it should be understood that the invention is not limited thereto or thereby but is defined in the appended claims.

Although particularly adapted for the manufacture of small gauge wire and rod from sheet or strip metal the invention contemplates the use of metal plate as a starting material. It should also be appreciated that elements of various cross-sectional contours, such as hexagonal, octagonal, square and the like, may be produced instead of rounds.

I claim:

75 1. Apparatus for making wire or rod from

metal in sheet form comprising a 4-high mill, means for supplying sheet metal to the mill under tension, work-engaging rolls in the mill for forming parallel opposed grooves on each side of the sheet spaced apart substantially the width of the wires to be formed, means for separating the sheet at the grooves to form a plurality of wire-like elements polygonal in cross section, means for rounding one half of the circumference of each element, other means spaced longitudinally of the elements from the first-named rounding means for rounding the other half of the circumference of each element, and means for pulling and coiling the elements under tension.

2. Apparatus for making wire or rod from metal in sheet form comprising sheet-engaging rolls for forming parallel opposed grooves on each side of the sheet spaced apart substantially the diameter of the wires to be formed, means for separating the sheet at the grooves to form a plurality of wire-like elements polygonal in cross section, means for rounding one half of the circumference of each element, other means placed after the first-named rounding means for rounding the other half of the circumference of each element, and means for coiling the elements.

3. In mechanism for making rod or wire from strip metal the combination which includes rotatable members for separating the strip into wire-like elements, a plurality of stationary means spaced longitudinally of the elements and each engaging with only a part of the circumference of the elements for trimming the elements to wire shape, and means for pulling the strip and elements under tension through the mechanism.

4. Apparatus for making wire or rod from metal in sheet form comprising a mill, means for supplying sheet metal to the mill, work-engaging rolls in the mill for forming parallel triangular grooves on the sheet spaced apart substantially the diameter of the wires to be formed, means for separating the sheet at the grooves to form a plurality of wire-like octagonally-shaped elements, means for shaping the circumference of each element comprising a stationary semi-circular die, a second stationary semi-circular die spaced longitudinally of the first-named die, and means for coiling the elements.

5. Apparatus for making wire or rod from metal in sheet form comprising means for separating the sheet to form a plurality of wire-like elements polygonal in cross section, means for rounding one half of the circumference of each element, other means remote from the first-named rounding means for rounding the other half of the circumference of each element, and means for pulling and coiling the elements under tension.

6. Apparatus for forming strands from flat sheet including a pair of driven rolls having opposed triangularly shaped ribs thereon adapted to form triangular slots on opposite sides of the sheet, a sticker for feeding the sheet into the rolls, a brake for tensioning the sheet in passing through the rolls, a pair of shearing rolls having alternate grooves and flanges, the flanges of each roll extending into the grooves of the other and adapted to shear the sheet through the slots to form a plurality of octagonally shaped strands, dies positioned above and below the strands, rollers for directing each strand against the upper dies and against the lower dies for shaping each strand substantially round, and a coiler for pulling and coiling the strands under tension.

7. Apparatus for forming strands from flat sheet including a pair of driven rolls having opposed ribs thereon adapted to form slots on opposite sides of the sheet, and a pair of rolls having alternate grooves and flanges, the flanges of each roll being aligned with the grooves of the other and adapted to separate the sheet through the slots to form a plurality of octagonally shaped strands, stationary dies positioned above and below the strands, rollers for directing each strand against the upper dies and against the lower dies for shaping each strand substantially round, and a collar for pulling and coiling the strands under tension.
8. Apparatus for forming strands from flat sheet including a pair of driven rolls having opposed ribs thereon adapted to form slots on opposite sides of the sheet, a pair of rolls adapted to separate the sheet through the slots to form a plurality of strands, stationary semicircular dies positioned above and below the strands, rollers for directing certain of the strands against the upper dies and other of the strands against the lower dies for shaping part of the circumference of the directed strands substantially round, and a collar for pulling and coiling the strands under tension.
9. The method of making wire or rod from metal sheet which comprises forming parallel triangular grooves on opposite sides of the sheet, said grooves being spaced apart substantially the width of the wire being formed, separating the sheet at the grooves into octagonal wires, trimming substantially one half of the circumference of each wire to round, trimming the other half of the circumference of each wire to round, and coiling the wire under tension.
10. The method of making pure welding rod which comprises rolling an ingot to sheet form, shearing approximately one-eighth of the total width of the sheet off each side of the sheet, forming opposed parallel triangular grooves on opposite sides of the sheared-off portions of the sheet, said grooves being spaced apart substantially the diameter of the rod to be produced, separating the sheet at the grooves into rods octagonal in cross section, pulling the rods under tension across dies to trim approximately one half of the circumference of each rod to round, pulling the rods under tension across other dies to trim approximately the other half of the circumference of each rod to round, and coiling the rods.
11. The method of making wire or rod from metal sheet which comprises the steps of separating the sheet into wire-like elements, trimming substantially one half of the circumference of each element, trimming the other half of the circumference of each element at a point remote from the first trimming point, and maintaining the element under tension during the trimming operation.
12. The method of making rod which comprises forming opposed parallel triangular grooves on opposite sides of a metal sheet, said grooves being spaced apart substantially the diameter of the rod to be produced, separating the sheet at the grooves into rods octagonal in cross section, pulling the rods under tension across dies to trim approximately one half of the circumference of each rod to round, and pulling the rods under tension across other dies to trim approximately the other half of the circumference of each rod to round.
13. The method of making rod which comprises forming opposed parallel grooves on opposite sides of a metal sheet, said grooves being spaced apart substantially the diameter of the rod to be produced, separating the sheet at the grooves into rods, pulling the rods under tension across dies to trim approximately one half of the circumference of each rod to round, and pulling the rods under tension across other dies spaced longitudinally of the first-named dies to trim approximately the other half of the circumference of each rod to round.
14. The method of making rod which comprises forming opposed parallel grooves on opposite sides of a metal sheet, said grooves being spaced apart substantially the diameter of the rod to be produced, separating the sheet at the grooves into rods, separating the rods into groups defining parallel planes, and pulling the rods under tension across stationary longitudinally spaced dies each engaging with only part of the circumference of a rod to trim each rod to the desired cross-sectional contour.
15. That method of making wire from metal strip which includes rolling the strip to provide channels therein defining the wires, rolling the channeled strip to separate it into wire-like elements of polygonal cross section, and drawing the elements under tension in turn through a plurality of longitudinally spaced dies each of which only partially surrounds the elements but all together completely surrounding the elements to shape the elements to wires.
16. That method of making wire from metal strip which includes rolling the strip to separate it into wire-like elements of polygonal cross section, and drawing the elements under tension through a plurality of dies each of which only partially surrounds the elements but all together work in axially spaced relation completely over the surface of the elements to shape the elements to wires.
17. Apparatus for forming strands comprising a plurality of longitudinally spaced stationary dies each adapted to engage with and trim a strand over a portion of its circumference but together and in sequence engaging with the entire circumference of the strand, and roller means for directing the strand into engagement with the dies in turn.
18. Apparatus for forming wires from flat sheet metal comprising means for severing the sheet metal into strands, means for dividing the strands into groups lying in different planes, means for trimming substantially a circumferential half of each strand in one group and means operating substantially simultaneously with the first trimming means for trimming substantially a circumferential half of each strand in the second group, means for reversing the position of the planes of the groups, means for completing the trimming of the circumference of each strand in one group, and means for completing the trimming of the circumference of each strand in the other group.
19. Apparatus for forming wires from flat sheet metal comprising means for severing the sheet metal into strands, means for dividing the strands into groups lying in different planes, means for trimming part of the circumference of the strands while in the different planes, means for changing the position of the planes, and means for trimming the remainder of the circumference of the strands in the changed position of the planes.

20. That method of making wire from metal strip which comprises separating the strip into a plurality of strands, dividing the strands into groups lying in different planes, trimming substantially a circumferential half of each strand in one group and substantially simultaneously

trimming substantially the other circumferential half of each strand in the other group, reversing the position of the planes of the groups and completing the trimming of the strands in each group substantially simultaneously.

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